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# Selling and Renting Information Goods: Case of E-books

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## ABSTRACT

The growth in electronic publishing, advancement in e-book reader technology and the advent of the internet has led to the emergence of e-books and a rental market for e-books. When the product is available in both digital and physical form, consumers' willingness to buy is influenced by their preference for the form of the product (physical vs. digital) and their valuation of the product. Books are experience goods and consumers realize the true fit of the book to their tastes only after they have used the book for some time. Renting of e-books provides a sampling opportunity to the consumers. In this paper we examine the pricing and product line design strategies for the retailer through a two stage consumer behavior model. Finally, computational analysis is used to develop additional insights that cannot be obtained analytically. We recommend distinct pricing and renting strategies for underestimated and overestimated books. A key result is that providing an e-book is always optimal, and the retailer's profit increases as the consumers' preference for an e-book increase. We also found that it is not always optimal for a retailer to increase the consumer's initial fit-perception.

## Keywords

E-books, digital goods, experience goods, renting.

## INTRODUCTION

Emerging technologies create new opportunities as well as challenges. Due to advancement in digitization technology many products like magazines, music albums, movies and books etc are available in both physical as well as digital format. The seller of these multiform products faces the challenge of determining the right business model to sell the products.

In this paper, we present the analysis of one such multiform product - books. Books are now available as (1) p-books (books available in physical format) and (2) e-books (books available in electronic format). With the growth of internet and electronic publishing, e-book market is profusely growing (Gunter, 2005). When Stephen King's novella, *Riding the Bullet*, was released in digital format on the internet, more than 500,000 people downloaded it within one week of publication (Long, 2003). According to the quarterly reports put out by IDPF, e-book sales represented the publishing industry's fastest growing sector in 2004. There have been many optimistic forecasts about the e-book market. For example, (Spiselman, 2001) forecasted that the American e-book market would grow dramatically, and by 2010 e-book and p-book market will be about equal in size. Mainstream publishing houses such as Taylor & Francis, O'Reilly, Addison Wesley, Sams, Prentice Hall, Microsoft Press, IBM Press, McGraw Hill have also entered the e-book market. Amazon.com is also moving aggressively into digital books. It sells digital versions of most of its titles, available for instant download.

With the emergence of the e-book and the advent of high speed internet, renting e-books became a viable option for online retailers. Consumers can rent an e-book to read online for fixed period of time, but they are not allowed to download or take printouts, e.g. Taylor & Francis, Blackwell, SafariX provides e-books which users can access from their website for a fixed time for fee. The consumer of the book would rent rather than buy if, (a) he requires the book for a short period of time and will not use the book thereafter; or (b) he wants to evaluate (sample) the book, an experience good (Nelson, 1970), before making a purchase. Sampling has a positive effect on incremental sales for certain products, which has been demonstrated extensively in marketing literature (Jain, Mahajan and Muller, 1995). However, if the valuation decreases after sampling, it can result in loss of sales. Both e-books and renting of e-books can also potentially cannibalize sales of p-books. In practice, decision of introducing multiform products is not a straight forward one for online retailer. (Venkatesh and Chatterjee, 2006) have argued that consumers have different preferences for an electronic offering relative to print version for magazines. Also, for experience goods, the retailer needs to take into account the initial information that consumers have about them

(Chellappa and Shivendu, 2005) and different strategies are needed when a market overestimates vs. underestimates the product (Shapiro, 1983). Under these circumstances it is not surprising that most online retailers are experimenting with new business models to sell the books in electronic format. For example, Amazon.com provides the option of buying e-books for some books, Taylor and Francis provides the option of renting e-books and buying e-books for all the books available from their website. In this paper, we are examining a new business model for an online retailer who has the option of selling p-books, e-books and renting e-books through an online channel. Specifically, we examine the pricing and product line design strategies for an online retailer through a two stage consumer behavior model.

## LITERATURE REVIEW

Previous research on pricing and segmentation aspects of experience and digital goods is related to our work but there are key differences that set our work apart. In the following we identify similarities to these bodies of work while emphasizing differences.

(Mussa and Rosen, 1978) were the first to examine vertical differentiation in a market with heterogeneous consumers. They model heterogeneity of consumers with a continuous parameter and use a linear utility function. They conclude that the monopolist would find it optimal to price discriminate by offering multiple qualities. (Chellappa and Shivendu, 2005; Choudhary, Chaturvedi, Tomak, 1998; Frederick, 2004; Moorthy and Png, 1992; Shapiro, 1983; Varian, 2000) have considered the market segmentation of goods which can be differentiated based on the quality. (Jain and Kannan, 2002; Sundararajan, 2004) have also studied price discrimination under quantity price schedule.

Recently, several studies have examined the benefits of selling goods online. (Lynch and Ariely, 2000) found that consumers are willing to pay higher prices for goods sold online. (Schaupp and Belanger, 2005) found that convenience associated with buying goods online is an important factor of online consumer satisfaction. In an empirical study, (Chun and Kim, 2008) found that as it becomes easier to obtain goods and services online, the prices charged by the online market tend to exceed those charged by the traditional offline market. However, these studies have not considered the concurrent selling of multiform products in both online and physical format online.

The earliest work on renting/leasing decision relates to the realm of the durable goods monopolist literature in economics (Bucovetsky and John, 1986). (Desai and Purohit, 1998) found that different combinations of leasing and selling are possible depending on the rates at which leased and sold goods depreciate based on their model on the market for new and used cars. The economics of books differs from the above since there is no physical depreciation. (Knox and Eliashberg, 2005) have modeled consumer's rent vs. buy decisions for home videos. In their setting, consumer valuation only decreases with each experience. In case of books consumer valuation can increase after renting.

Business models on economics of subscription pricing and shared goods have usually focused on physical products. (Glazer and Hasin, 1982; Ordovery and Willig, 1978) have analyzed the journal subscription model. (Coyte and Ryan, 1991) extended the subscription model and examined a consumer's decision to purchase or renew a subscription of a book. Recently, (Venkatesh and Chatterjee, 2006) have studied a pricing problem for journals which are available in both electronic and physical format. They have studied the problem from the publisher's perspective who is selling a particular magazine directly to the consumer. They found that offering online version is always optimal even when market strongly prefers print medium. However, they have not considered uncertainty in the consumer valuation.

While several studies have examined digital goods, but the main emphasis has been on issues related to piracy or free samples. (Conner and Rummelt, 1991; Givon, Mahajan, Muller, 1995; Gopal and Sanders, 1997; Gopal and Sanders, 1998; Gopal and Sanders, 2000) have examined the consumer's decisions to purchase or pirate the software product. (Bhattacharjee, Gopal, Lertwachara, 2006) have modeled different emerging market environments for music retailers. In these papers the authors assumed that free samples are available and consumer will always sample before making a purchase decision.

To the best of our knowledge, concurrent renting and selling of multiform products has not been addressed in the literature particularly in the context of uncertainty in consumer valuation. The marginal cost of digital versions is negligible and renting provides additional sources of revenue. However, there are some potential downsides such as cannibalization of established revenue streams and need to choose from complex strategy space. The explicit consideration of these elements along with uncertainty in consumer's valuation and sampling mechanism for which consumers have to pay a fee has yielded results that are interesting and different from those in the extant literature.

## THE MODEL

In this model, we are considering a monopolist retailer who has the option of selling p-books, e-books and renting e-books through an online channel. The marginal cost of an e-books is assumed to be zero (Chellappa and Shivendu, 2005; Glazer and Hassin, 1982; Gopal and Sanders, 1997) and the marginal cost of p-books is  $C_p$ . The online retailer offers p-books at a price  $P_p$ , e-books at a price  $P_e$  and rents e-books at a price  $P_r$ .

The market consists of surplus-maximizing potential consumers. Consumers are heterogeneous in their valuation of the p-book. The consumer's valuation of a p-book is denoted by  $V$  and has a uniform distribution in the interval  $[0, 1]$ . The assumption of uniformity and statistical independence is common in the literature on pricing of information goods (Choudhary et al. 1998). The distribution of valuation across consumers is known to the retailer, but the retailer does not know the valuation of a particular consumer. The consumers' preference for an e-book relative to a p-book will depend on the type of the book. For certain types of books like reference books, consumers would like to have digital copy of books so that they can search easily. However, for other types of books such as compilations of artistic works, consumer will prefer a p-book. The parameter  $b$  models the preference (common to all consumers) for an e-book. If  $b < 1$ , then consumers prefer an e-book less than a p-book and if  $b > 1$ , then consumers prefer an e-book more than a p-book. Since consumers can rent e-books only for limited period of time and they are not allowed to download or take printouts, there is some disutility from renting. The parameter  $r \in (0, 1)$  models the reduced utility (common to all consumers) from renting an e-book as compared to buying it.

Books are experience goods (Nelson, 1970) whose true value can be realized only after consumption. While the consumers know their valuation of a particular book, consumers have uncertainty about a book's fit to their preferences or tastes, known as private information contained within an experience good (Nelson, 1970; Shapiro, 1983). The consumers form an initial perception based on their past experiences of books by same author or publisher, word of mouth communication, advertising and reviews etc. However, as (Shapiro, 1983) pointed out that these sources have limitations and true value is known only after consumption. We model fit perception based on an analytical model by (Chellappa and Shivendu, 2005). In our model, we denote the consumers' perception of how a product fits to their tastes or preferences by  $k \in (0, 1)$ . Thus the consumer's utility: from buying a p-book is  $U_p = kV - P_p$ ; from buying an e-book is  $U_e = kbV - P_e$  and from renting an e-book is  $U_r = kbrV - P_r$ . We represent the initial perception (common to all consumers) by  $k = k_o$ , where  $k_o$  may be less than or greater than the true fit of the book. We classify e-book to be of two types such that after consumption, we have  $k = 1$ , suggesting that the book fully matched the consumer's tastes and was initially *underestimated*, or  $k = 0$ , implying that the book was initially *overestimated*. Before the book is introduced into the market, the retailer can determine whether the book will be underestimated or overestimated in the market by forming focus groups.

We develop a two-stage model for renting. In the first stage, consumers decide between buying an e-book, buying a p-book, renting an e-book, or not participating in the market. While the buying and not participating actions are final, renting is transient because consumers who rent in the first period may change their decision based on updated valuation and buy either an e-book or a p-book in the second period. Since consumers rent e-book either to sample the book or when they need book only for a short period of time, they will not rent in the second period (Choudhary et al. 1998). The retailer will set prices to maximize his total profit from both the periods. The vendor would take into account the consumers' individual rationality (IR) and incentive compatibility (IC) constraints.

### Overestimated Books

In this section, we will give detailed analysis for books for which preference for an e-book is less than that of a p-book i.e.  $b < 1$ . Let the valuation of marginal consumer who is indifferent between: buying a p-book and buying an e-book (i.e.  $U_p = U_e$ ) is  $V_{pe}$ , buying an e-book and not buying an e-book (i.e.  $U_e = 0$ ) is  $V_e$ , buying a p-book and not buying it (i.e.  $U_p = 0$ ) is  $V_p$ , buying a p-book and renting an e-book (i.e.  $U_p = U_r$ ) is  $V_{pr}$ , buying an e-book and renting an e-book (i.e.

$U_e = U_r$ ) is  $V_{er}$ , renting e-book and not renting (i.e.  $U_r = 0$ ) is  $V_r$ . Solving the indifference equations for marginal consumers, we get

$$V_{pe} = \frac{(P_p - P_e)}{k_o(1-b)}, V_p = \frac{P_p}{k_o}, V_e = \frac{P_e}{k_o b}, V_{pr} = \frac{P_p - P_r}{k_o(1-rb)}, V_{er} = \frac{P_e - P_r}{k_o b(1-r)}, V_r = \frac{P_r}{rb} \quad (1)$$

When a retailer sells both a p-book and an e-book and rent an e-book following inequalities will hold (Proof not provided here for brevity):

$$1 \geq V_{ho} \geq V_{hr} \geq V_h \geq V_o \geq V_r \text{ And } V_{hr} \geq V_{or} \geq V_o \quad (2)$$

Equations (1) and (2) give following regions for prices:

$$rP_e \geq P_r, bP_p \geq P_e, \frac{(P_p - P_e)}{(1-b)} \geq \frac{(P_e - P_r)}{(1-r)b}, (P_p - P_e) \leq k_o(1-b) \quad (3)$$

Since  $U_p - U_e$ ,  $U_e - U_r$  and  $U_r$  are all increasing functions of  $V$ , all the consumers with valuation in: interval  $(V_{pe}, 1)$  will buy p-book, interval  $(V_{er}, V_{pe})$  will buy e-book, interval  $(V_r, V_{er})$  will rent e-book and interval  $(0, V_r)$  will not buy anything. Figure 1 summarizes the consumer valuations and demands for e-book and p-book and rent of e-book. Note that these demand functions are valid in the region given by (3).

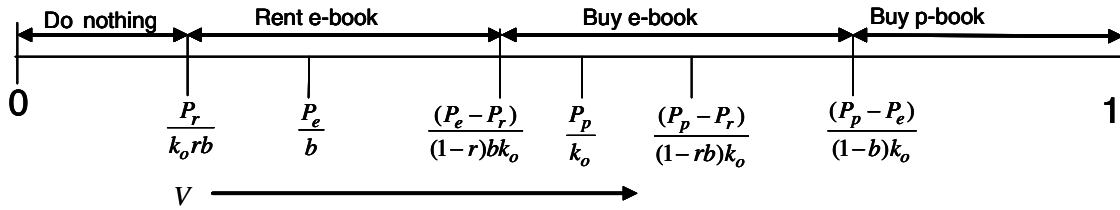


Figure 1. Consumers' Valuation and Demand

The profit function of retailer in this case is given by:

$$\text{Max } \pi_1 = \left(1 - \frac{(P_p - P_e)}{k_o(1-b)}\right)(P_p - C_p) + \left(\frac{(P_p - P_e)}{k_o(1-b)} - \frac{P_e - P_r}{k_o b(1-r)}\right)(P_e) + \left(\frac{P_e - P_r}{k_o b(1-r)} - \frac{P_r}{k_o r b}\right)(P_r)$$

The analysis for  $b > 1$  is similar. We were able to find closed form solutions for prices and profits for both cases, but have not reported the results for brevity.

### Underestimated books

We were not able to find closed form solutions for all market conditions for underestimated books. To get additional insights, we used numerical methods to find prices and profits under different market conditions. We created 100 synthetic consumers corresponding to uniformly dispersed nodes in one dimension representing valuation of the p-book. For different scenarios, represented by a specific  $(k_o, r, C_p, b)$ , we determined the optimal prices and profits using a fine grid search procedure.

### Optimal product Mix

Table 1 & 2 gives optimal products to sell under different conditions for overestimated books and underestimated books respectively.

Preference for e-book less than p-book ( $b < 1$ )	Marginal cost < Maximum Price Premium ( $C_p < k_o(1-b)$ )	Marginal cost $\geq$ Maximum Price Premium ( $C_p \geq k_o(1-b)$ )
	p-book & e-book. ( $P_p > P_e$ )	e-book ( $P_e$ )
Preference for e-book greater than p-book ( $b > 1$ )	e-book ( $P_e$ )	

Table 1. Optimal product mix for Overestimated books

Preference for e-book less than p-book ( $b < 1$ )	Marginal cost < Maximum Price Premium ( $C_p < (1-b)$ )	Marginal cost $\geq$ Maximum Price Premium ( $C_p \geq (1-b)$ )
	p-book, e-book & rent e-book. ( $P_p > P_e > P_r$ )	e-book & rent e-book ( $P_e > P_r$ )
Preference for e-book greater than p-book ( $b > 1$ )	e-book & rent e-book ( $P_e > P_r$ )	

Table 2. Optimal product mix for Underestimated books

The economic intuition for the above results is as follows: for overestimated books, the cannibalization effect of renting e-books in the first period dominates additional revenue from renting e-books, so the retailer will never rent e-books. For underestimated books, some of the customers who rent in first period buy books in second period. The additional revenue from rent and sales in second period dominates cannibalization effect of renting in first period and hence, retailer will always rent e-books. We define **price premium (PP)** as the difference between the maximum price which the consumer is willing to pay for a p-book and the maximum price which the consumer is willing to pay for an e-book. This difference is maximum for consumer with highest valuation (i.e.  $V=1$ ) and we call this as **maximum price premium (Max PP)**. If the preference for an e-book is less than that of a p-book (i.e.  $b < 1$ ) and the marginal cost of a p-book is less than *Max PP*, then a retailer can earn higher profits by selling a p-book to customers with a higher valuation (customers for whom  $PP >$  marginal cost of p-book), and selling e-book to customer with lower valuation (customers for whom  $PP <$  marginal cost of p-book). If  $b < 1$  and *Max PP* < marginal cost of p-book, the retailer can never earn higher profits by selling p-book and hence he sells only e-book. When preference for e-book is greater than that of p-book, and since marginal cost of e-book is zero, retailer can earn higher profits by selling only e-books.

## SENSITIVITY ANALYSIS

**Overestimated Books:** As preference for e-book increases, the price of an e-book and a p-book and retailer's profit increases. Also as initial perception of fit to taste increases the price of an e-book and a p-book and retailer's profit increases. These results were obtained from comparative statistics. For overestimated books, demand in second period is zero, as initial perception and preference for e-book increases, the customers' willingness to pay increases and so the retailer charges higher prices and his profits also increases.

**Underestimated Books:** As preference for e-book increases, the price of an e-book, rent price of an e-book and profit always increases (See figure 2a, 2b & 2e). However, the price of p-book first increases and then decreases (See figure 2d). The economic intuition behind this is that at low values of preference for an e-book the retailer can segment the market by selling p-books to consumer with higher valuation and selling e-books to consumers with lower valuation and as the preference for e-book increases, the retailer can increase the prices of both e-book and p-book. However as the preference for e-book becomes very high, the retailer has to lower the price of p-book to prevent consumers with high valuation from buying e-book, which is sold at lower price than p-book.

As initial perception of fit to taste increases, the price of an e-book and price of a p-book, rent price of an e-book and profit of retailer first increases and then decreases (see figure 2a, 2b, 2c, 2e). The economic intuition behind this is that at low values of initial perception of fit to taste, as initial perception of fit to taste increases, the retailer can earn higher profits by increasing the rental price. However, when initial perception of fit to taste is very high, the demand for rent will decrease and to induce more consumers to rent, the retailer has to decrease the rental price. For underestimated books, the retailer will like maximum people to first rent and then purchase at a higher price in the second stage. Hence, initially as initial perception of fit to taste increases, the retailer increases the price of e-book and p-book so that consumers purchase e-book and p-book at a higher price in the second period only. However, at very high values of initial perception of fit to taste, the demand of rental decreases and since after renting there is not much change in the valuation, very few consumers will purchase in the second period. Hence, retailer has to lower the price of both the e-book and p-book to induce people to make a purchase in the first period.

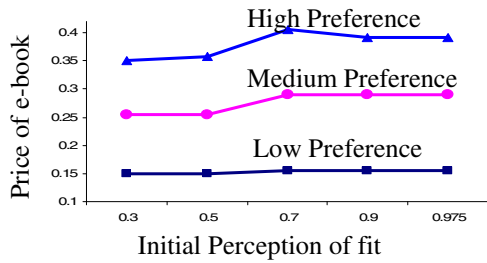


Figure 2a. Effect of initial perception of fit and preference for e-book on price of e-book

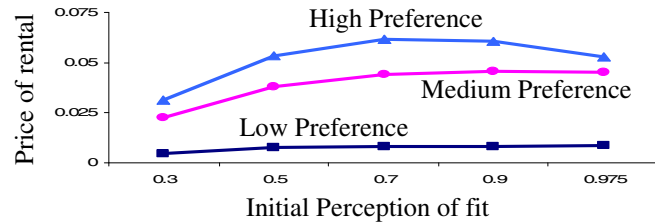


Figure 2b. Effect of initial perception of fit and preference for e-book on price of rental

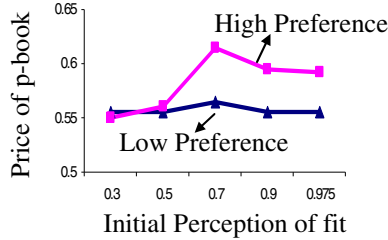


Figure 2c. Effect of initial perception of fit and on price of p-book

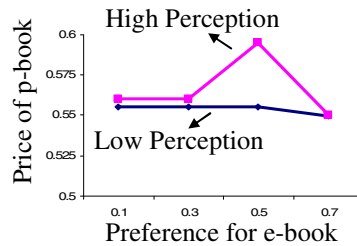


Figure 2d. Effect of preference for e-book on price of p-book

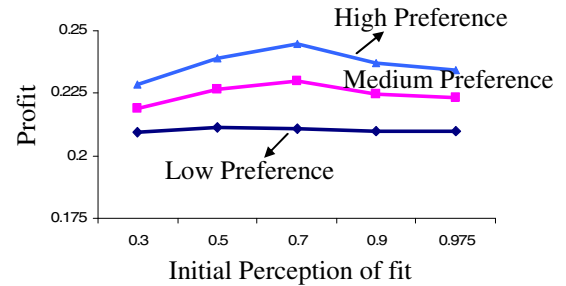


Figure 2e. Effect of initial perception of fit and preference for e-book on profit

## DISCUSSION AND CONCLUSION

We develop a two-stage pricing model for a vertically segmented market where consumers are heterogeneous in their willingness to pay, and consumers who rent in the first stage decide between buying and not buying in the second stage after having updated their perception of fit. We then derive optimal prices for overestimated books and study the efficacy of renting strategies for overestimated books. However, pricing and retailer profits do not have closed-form solutions for many market conditions for underestimated books. We conduct computational analysis to gain insights for different market conditions. The key results from our analysis are:

- Providing e-book is always optimal even when preference for e-book is very low.
- For underestimated books, renting is always optimal and prices are higher than no renting case.
- For overestimated books renting is never optimal.
- As the preference for e-books will increase, the profit of online retailer will increase.
- Increasing initial perception of fit does not always increases profits.

### Implications to Theory and Practice

From a theoretical perspective, we integrate research from literature in economics on market segmentation, information systems research on digital experience goods, and marketing literature on sampling. The main purpose of our study is to analyze new opportunities and challenges that arise from existence of products in both physical and digital forms. The potential benefits arise from negligible marginal cost of digital versions and additional sources of revenue. However, there are some potential downsides such as cannibalization of established revenue streams and need to choose from complex strategy space. The explicit consideration of these elements along with uncertainty in consumer's valuation and sampling mechanism for which consumers have to pay a fee has yielded results that are interesting and different from those in the extant literature. For example, (Chellappa and Shivendu, 2005) suggested that for underestimated products raising the initial perception allow greater surplus to be extracted from high-type consumers by raising the price, but we find that under certain conditions as initial perception increases both prices and profits decreases.

We emphasize a few guidelines for online retailers. Even for books for which consumers have very low preference for e-books, introducing e-books to complement p-books will increase the profits. Amazon is moving aggressively into digital books. It sells digital versions of most of its titles, available for download instantly. Our results indicate that when retailers sell both e-book and p-book, the price of p-book is always greater than that of e-book. From our initial analysis of data from Amazon.com, we found the price of p-book to be always higher than that of e-book.

The retailer can increase his profits by increasing the consumers' preference for e-book. The retailer can influence the consumers' preference in following two ways: (1) by granting digital rights such as right to print and enhancing search capabilities for e-books, which will encourage e-book adoption and will increase users' preference for e-books, (2) by actively involving in standardization of software and reading devices and development of better e-book devices. The major impediment earlier in development for the market of e-books has been the poor quality of e-book readers and lack of standardization of devices and software used for reading e-books (Long, 2003). Many online retailers like Amazon have taken right steps in this direction by joining IDPF (International Digital Publishing Forum is a trade and standards organization dedicated to the development and promotion of electronic publishing). The main aim of IDPF is developing, publishing, and maintaining common specifications relating to electronic books and promoting the successful adoption of these specifications. The vendor can invest in increasing the initial perception to fit e.g. the recommendation system and search inside initiative of Amazon are used by Amazon to increase the initial perception of fit. From our analysis, we found that as initial perception of fit increases, the profit first increases and then decreases. Hence, there is an optimal amount which a vendor should invest on increasing the initial perception of fit to taste.

### Limitations and Future Research

By looking at monopoly behavior, we simplified the real world situation to gain an insight into the effect of such a market on the retailer's decision. Including the effects of competition from other online retailers is a logical extension in the context of multiform products. The e-books offer unique opportunity for splitting the books and selling individual chapters. Besides outright purchases and rental options retailers can also introduce the cost effective services of page/chapter micro-purchases of content. The effect of including micro purchases into retailers' strategy will be an interesting extension. It will also be interesting to explore contracts between publishers and retailers. We are considering the empirical validation of key results in future work. Specifically we are planning to test following results: (1) the effect of increase of preference for e-book on prices (2) when both p-book and e-book are sold concurrently, the price of p-book is always greater than e-book.

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